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# The Way forward

## Challenges for a changing Nordic power system

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Florence Forum, May 26th 2017

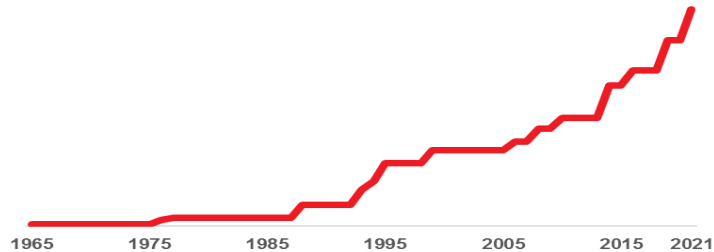


# The changes of the Nordic power system are driven by climate policy, technology development and integration

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The main changes are:

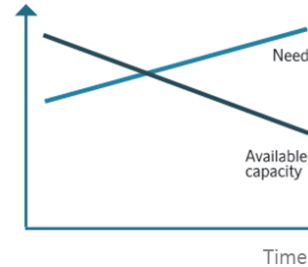
- The closure of thermal power plants
- Rising share of wind power
- Decommissioning of Swedish nuclear power plants
- Increase in interconnector capacity out of the Nordic power system



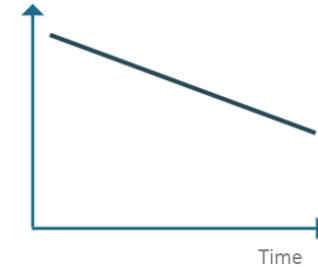
# Challenges in the Nordic power system



Increased demand for flexibility

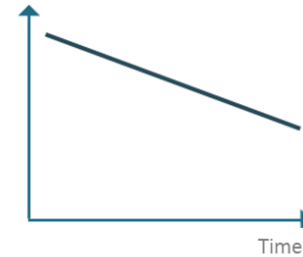


Adequate generation and transmission capacity to ensure security of supply

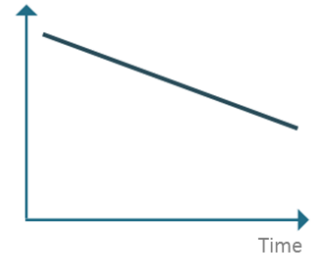


Time

Inertia to support system stability



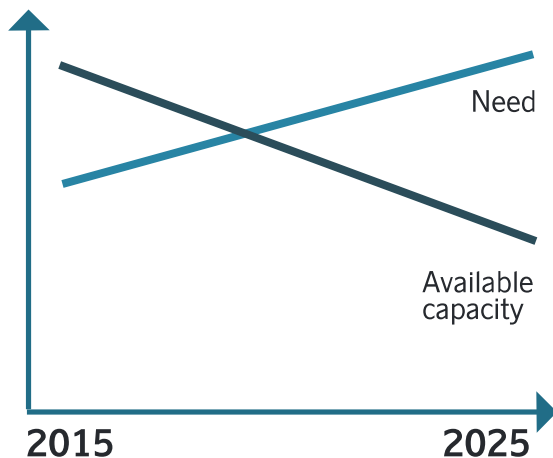
Frequency quality to ensure operational security



## Increased demand for flexibility

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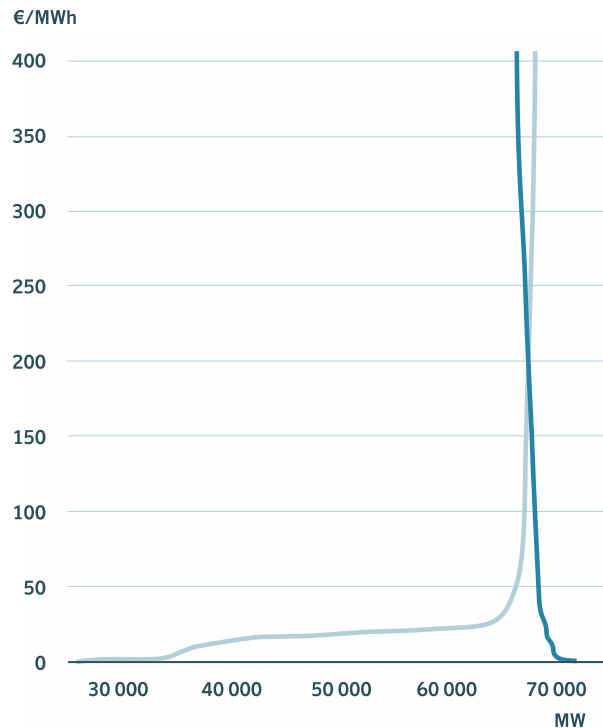
Increased demand for flexibility



### Challenges

- Current price caps affect the price formation
- Periods of insufficient balancing resources available in the operational hour

# Adequate generation to ensure security of supply

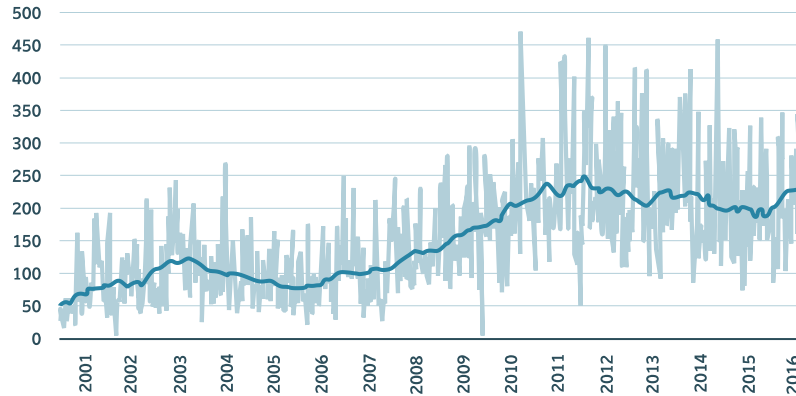


Demand-supply balance in the Nordic power system on 21 January 2016.

## Challenges

- Ensuring flexible capacity with market signals
- Lack of adequate assessments and methodologies

# Maintain good frequency quality to ensure operational security

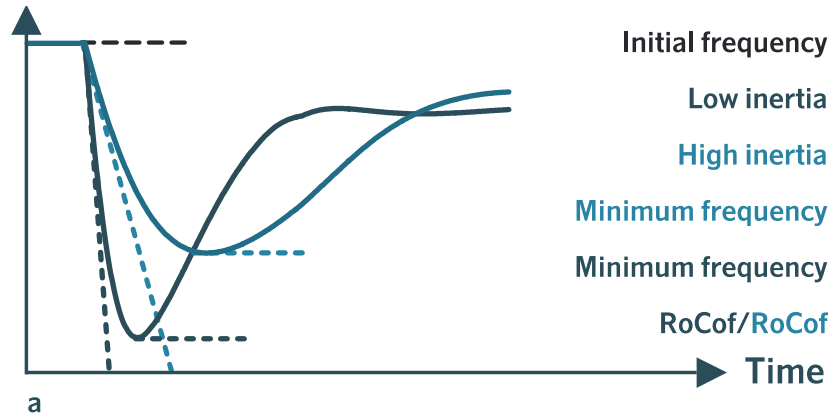


Minutes per week outside the normal frequency band (49.9-50.1 Hz)

## Challenges

- Larger imbalances caused by ramping
- More unpredictable power generation
- Increased need for, but reduced access to, reserve capacities
- Availability of transmission capacity for frequency and balancing reserves

# Sufficient inertia to support system stability



Frequency and power response after a generator trip

## Challenges

- Sufficient inertia in the system to ensure operational security
- Insight in how low level of inertia the system can handle

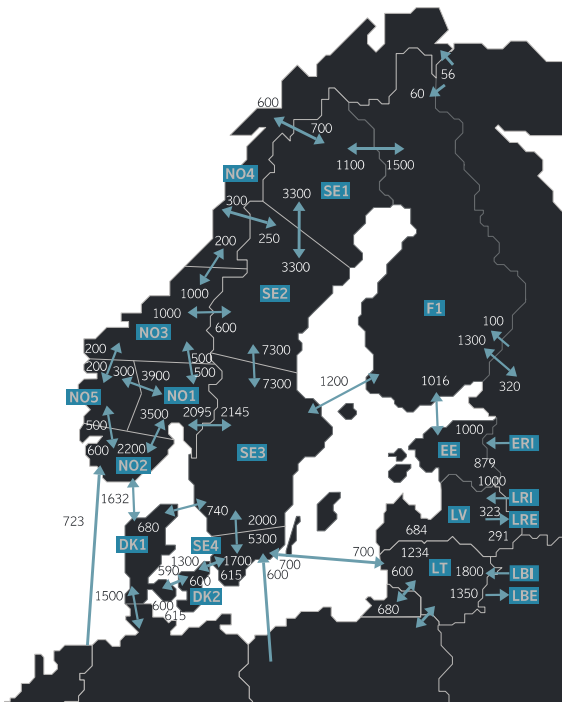
## Possible solutions to meet the challenges

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- Introduce higher time resolution
- Utilize the transmission capacity more efficiently
- Demand side response
- Stronger incentives for the Balance Responsible Parties to support the system
- Harmonize products and market solutions for frequency and balancing regulation
- Identify mitigation measures to address adequacy in a Nordic perspective
- Market solutions or incentives to ensure that enough inertia is maintained in the system at all times
- Technical specifications to increase inertia in the system



# Transmission adequacy to ensure security of supply



## Challenges

- Value all benefits when planning the transmission network
- Maintain operational security and an efficient market while reconstructing the grid

## Possible solutions

- Improve modelling tools and a robust scenario strategy
- Clarify differences and common goals for grid development in the Nordic countries
- Develop the grid and additional transmission capacity

# Input from Stakeholders is key to identify effective tools/solutions

